2013 - 2014

POWER & ENERGY LABORATORY

Research Activities:

- Development of a calibrator for on-site calibration of energy analyzers.
- Development of a test set for the testing of low power current transformers.

• Development of a calibrator for the calibration of electronically-compensated isolation current transformers.

• Development of a calibration method for on-site calibration of power loss measurement systems.

EMRP Projects:

• S05 Q-Wave (A Quantum Standard for Sampled Electrical Measurements): Laboratory is working on the design of wide-band amplifier by examining CFA type amplifiers with Spice analysis.

• IND60 EMC (Improved EMC Test Methods in Industrial Environments): Laboratory is working on the development of alternative test methods for power quality parameters.

• ENG63 GridSens (Sensor Network Metrology for the Determination of Electrical Grid Characteristics): Laboratory participates in the WP2 (Onsite application of network observation algorithms) and WP3 (Application of new measurement techniques for state estimation) of the project. In WP2, UME liaising with SEDAŞ grid operator provides NPL with topology information and data from sensors installed on the distribution grids. Further measurements may also be made where important sensor data is not available. In WP3, UME will obtain actual smart meter data for aggregation into one data point representing a nodal point as input for state estimation algorithms.

• ENG61 FutureGrids (Non-Conventional Voltage and Current Sensors for Future Power Grids): Laboratory is responsible for the development of high precision Rogowski Coils (RCs) in WP2 (Development of novel sensor technologies). In WP3 (Testing and calibration of non-conventional sensors), laboratory has responsibilities for the design of high precision voltage to current transducers for the calibration of current sensors. And, the step-up and step-down voltage transformers to make the output voltage level of voltage sensors suitable for the input voltage level of the commercial test sets in the voltage sensor testing.

Other Projects:

• "Design of Energy Analyzer Calibrators for TEIAS - Turkish Electricity Transmission Company". 2014-2015

• "Design of Power & Energy Measurement Standards for SASO - Metrology Institute of Saudi Arabia", 2014-2016

• "Robust Design of High Precision Instrument Current and Voltage Transformers and Kombi Sensors", National Support Programme for Cooperation Between Universities and Industry (1505), project no: 5130048, 2014-2015

• "Development of Electronically-compensated ICTs for KEDS - Kosovo Electricity Distribution Company", 2014

Comparisons:

• EURAMET Project 1187: Comparison of Instrument Current Transformers up to 10kA.

Extending Capabilities:

- Calibration of Current Transformers up to 10kA.
- · Calibration of Electronic Current Transformers with analog outputs: Rogowski, LPCT
- Calibration of Electronic Voltage Transformers: Resistive and Capacitive Voltage Dividers with the output voltages in mV level and few Volts.

Publishment:

• Hüseyin Çaycı, "A Simple Method for the Measurement of Instrument Current Transformer Burdens", Conference on Precision Electromagnetic Measurements (CPEM), Rio de Janeiro, Brazil, 24-29 August 2014

• Hüseyin Çaycı, "Reliability of Electricity Meters And Traceability in Measurements: A Case Study", ICSG 2014, Istanbul, Turkey, 8-9 May 2014

• Özlem Yılmaz, Gökmen Hasancebi, Hüseyin ÇAYCI, "State Estimation in Smart Electrical Grids", ICSG 2014, Istanbul, Turkey, 8-9 May 2014

2013 - 2014

ELECTROMAGNETIC (EMC and RF&MICROWAVE) LABORATORY

Research Activities:

Research activities are given under the following projects.

EMRP Projects:

• "Implementation New Kelvin". It was started in October 2012. The responsibility of the laboratory is developing and characterizing of the microwave transmission lines and microwave probes. In 2013 first generation transmission line were completed with success. Now we are working on the second generation transmission line for INRIM. The second generation transmission line is going to be adapted for INRIM system.

• EMRP IND60 "Improved EMC Test Methods in Industrial Environments" project has started in July 2013. UME is the coordinator of the project. The laboratory has many tasks and responsibilities in the project and the first year of the project has been completed. For alternative conducted emission tests, correction factors that will link industry to the laboratory were successfully obtained for actual EUTs such as a drill, a UPS on actual mains without LISN. All results obtained in alternative conducted methods were successfully connected to the measurements on LISN RF port.

For conducted immunity tests, loop impedances on the standard conducted immunity setup and nonstandard setups were measured and correction factors have been produced between the standard setup with CDNs and the alternative setups without CNDs like in industrial environment. Consequently, first efficient link between the standard and alternative methods has been established for conducted immunity testing. Impact of the induced impedance of the used current probes on the conducted immunity test results was also taken into account.

Other Projects:

• In the scope of the project for Egypt Metrology Institute, twin type microcalorimeter with N type connector is going to be produced.

Comparisons:

• RF and Microwave Laboratory joined "CCEM.RF-K5c.CL Scattering coefficients by broad band methods 100 MHz – 33 GHz – 3.5 mm connector" comparison . Measurements were done at UME in May 2014.

• RF and Microwave Laboratory will join "CIPM Key Comparison CCEM-RF-KXX.XX (CCEM GT-RF/13-18) Attenuation at 18 GHz, 26.5 GHz and 40 GHz using a step attenuator".

• EURAMET.EM.RF-S27 "Antenna factor for Loop Antennas" comparison has been officially completed.

Extending Capabilities: None

Publishment:

• M. Celep, Ş. Yaran, C. Hayırlı, A. Dolma, "Development of radiometer operating between 50 MHz and 26.5 GHz using gain-stabilized LNA", Turk. J. Elec. Eng. & Comp. Sci., in press.

• M. Celep and H. Sakarya, "Design and test of gas tight microwave transmission lines for resonance frequency measurements with cavity resonators up to 830 K", CPEM 2014 Conference, pp. 170-171, Brasil, August 2014.

• M. Celep, C. Hayırlı, Ş. Yaran, H. Sakarya and A. Dolma "Realization of Low Power Measurement System in the Range of -60 dBm – -120 dBm up to 26.5 GHz", CPEM 2014 Conference, pp. 172-173, Brasil, August 2014.

• S.Cakir, O. Sen, M. Cinar, M. Cetintas, "Alternative Conducted Emission Measurements for Industry", EMC Europe 2014, Gothenburg, Sweden, pp. 1037-1042, 1-4 September 2014.

• S. Cakir, O. Sen, M. Cinar, A. Ayaydin, M. Cetintas, F. Ustuner, "Effects of Sensor Positions on Military Radiated Susceptibility Tests", CPEM 2014 Conference, Rio De Janeiro, pp. 584-585, 24-29 August 2014.

• M. Cetintas, S. Cakir, O. Sen, M. Cinar, F. Ustuner, "Loop Antenna Pattern Measurements", CPEM 2014, Rio De Janerio, pp. 192-193, 24-29 August 2014.

2013 - 2014

MAGNETISM LABORATORY

Research Activities:

Synthesis, characterization and applications of magnetic nanoparticles, Measurement of ultra low magnetic fields around nT.

• Magnetic nanoparticles are synthesized and coated with biocompetible polymers, and then, characterised using X-ray diffractometry (XRD), scanning or transmission electron microscopy (SEM or TEM), VSM (vibrating Sample Magnetometer) to investigate their possible applications in biomedical area.

• Fluxgate magnetometers with different sensing elements, including superconductors, have been built and characterized.

EMRP Projects:

• MetMags: Metrology for Advanced Industrial Magnetics, (Coordinated by Dr Hans Werner Schumacher (PTB)). UME Work Package: Characterization of AMR films using magneto-optics

Other Projects: (Started up)

• Physically processed rapidly quenched alloys for detection of low magnetic fields: In collaboration with Slovak Academy of Sciences.

• Preparation of microwave absorbers using magnetic particles.

Comparisons:

• Measurement of magnetic flux density 25 to 700 mT using NMR magnetometer. Magnetic flux density between 25 and 700 mT will be measured with a reference NMR magnetometer and NMR of each NMI. Results will be compared. Participants: NPL, PTB, UME, METAS, INRIM, GUM and CMI. Travelling standard, NMR Magnetometer, is needed. Due to the lack of this standard , we could not get start. UME will be the pilot lab.

Extending Capabilities:

• We have started to establish Single Sheet Tester system to measure AC power losses in soft magnetic materials.

Publishment:

More than **30 papers** in SCI-index journals about magnetic nanoparticles and high sensitive magnetometers.

2013 - 2014

VOLTAGE LABORATORY

Research Activities:

- Investigation of the loading effects in the measurements of the ac voltage and ac current.
- Using sampling techniques in the measurement of the AC voltage.
- Setup of PJVS (Programmable Josephson Voltage Standard) using the PTB's chip

• Design of the probe for the PJVS standard using the components of the Conventional Josephson Voltage Standard of UME.

- Calibration of the high frequency milivoltages (1mV 200mV) @ (1-100MHz).
- Electrical characterization of solar cells

EMRP / EMPIR

• SIB59 Q-Wave "A quantum standard for sampled electrical measurements". RMG research, which is related with responsibilities of TÜBİTAK UME in WP4.2, has finished successfully. Deliverable 4.2.1 'List of identified error sources in generating and sampling systems' has finished. Deliverable 4.2.2 'Report on the analysis of error sources in generating and sampling systems' is being prepared. To support INRIM in the deliverable 3.2.4 software plan for calibrating Agilent/HP 3458A ADCs has been prepared. PJVS standard is being established for UME's responsibilities in WP3.

• EMPIR Project " ACQ PRO-Towards the propagation of AC Quantum Voltage Standards" has proposed. UME Voltage Laboratory is one of the participants.

Other Projects:

- Design of the Programmable Josephson Voltage System by using PTB array.
- Design of the new ac-dc current shunts.
- Automation of the calibration of the multifunction calibrators and meters.

Comparisons

• Protocol for "Supplementary comparison on calibration of Multimeter" has prepared. This work will be realized in the scope of Euramet Focus Group. Participants: BoM (MK), IMBiH (BA), DPM (AL), MBM (ME), GIM (PL).

Extending Capabilities:

• AC current measurement capability is extended to 100A @ 100kHz in the CMC database.

Publishment:

• "Design and Characterization of High AC-DC Current Shunt", Arifoviç M, Kanatoğlu, 8th National Metrology Conference, 26-28 September 2013, Gebze

• "Voltmeter Calibration at Low Voltages", Tezgül COŞKUN ÖZTÜRK, Saliha TURHAN, 8th National Metrology Conference, 26-28 September 2013, Gebze

• "Error Analysis In Waveforms Synthesized with a Combined Josephson System for AC Component Characterization", T. C. Öztürk, J. Kohlmann, O. Kieler, T. Möhring, R. Behr, H. Çaycı, M. Arifoviç, S. Turhan, L.D. Ata, Conference on Precision Electromagnetic Measurements, Rio, Brasil 2014

• "Structural and interfacial properties of large area n-a-Si:H/i-a-Si:H/p-c-Si heterojunction solar cells", Özlem Pehlivan, Deneb Menda, Okan Yılmaz, Alp Osman Kodolbaş, Orhan Özdemir, Özgür Duygulu, Kubilay Kutlu, Mehmet Tomak, Materials Science in Semiconductor Processing Volume 22, June 2014, Pages 69–75

2013 - 2014

HIGH VOLTAGE LABORATORY

Research Activities:

- Investigation of generation and measurement of current impulse systems
- Construction of new design divider using band-gap references for HVDC measurements
- Construction of partial discharge reference measuring system
- Development of lightning and switching impulse calibrator setup

EMRP Projects: None

Other Projects: None

Comparisons:

- EURAMET.EM-S33: Traceability of AC High Voltage Reference Measuring Systems up to 200 kV
- EURAMET.EM-S34: Traceability in high voltage capacitance and lost dissipation factor measurements
- Planned comparison: Traceability of Partial Discharge Measuring Systems
- Planned comparison: Traceability of LI and SI Measuring System

Extending Capabilities: None

Publications:

• DEDEOGLU, S., YILMAZ, S., "Design and implementation of a programmable high voltage impulse measurement system", Turkish Journal of Electrical Engineering & Computer ScincesPaper No:doi:10.3906/elk-1205-82, 2014

• J. Hallström, A. Bergman, S. Dedeoglu, A.P. Elg, E. Houtzager, T. Klüss, T. Lehtonen, W. Lucas, J. Meisner, A. Merev, M. Scmidt, E.P. Suomalainen, T. Nieminen and C. Weber, "Performance of a Modular Wideband HVDC Reference Divider for Voltages up to 1000 kV", to be submitted for publication in IEEE Transaction of Instrumentation and Measurements.

• A. Merev and J. Hallström, "A Reference System for Measuring High-DC Voltage Based on Voltage References", IEEE Transaction of Instrumentation and Measurements, to be published Doi. 10.1109/TIM.2014.2338673.

• J. Hallström, A. Bergman, S. Dedeoglu, A.P. Elg, E. Houtzager, W. Lucas, A. Merev, M. Meisner, J. Scmidt, E.P. Suomalainen and C. Weber, "Performance of a Wideband 200 kV HVDC Reference Divider", IEEE Transaction of Instrumentation and Measurements, Vol. 63, No. 9, pp. 2264-2270, Sept. 2014.

• A. Merev, "Evaluation of the Performance of Portable New Design High DC Voltage Measuring System up 40 kV", MAPAN-Journal of Metrology Society of India, Vol. 29, Issue 3, pp. 157-161, Sept 2014.

• A. Merev, S. Dedeoğlu and K. Gülnihar, "Erratum to: Evaluation of the Performance of Portable New Design High DC Voltage Measuring System up to 40 kV", MAPAN-Journal of Metrology Society of India, Vol. 29, Issue 3, pp. 163, Sept 2014.

• A. Merev and J. Hallström, "Evaluation of Long-Term Stability of HVDC Measuring System Based on Bandgap References", 2014-CPEM (Conference on Precision Electromagnetic Measurements), pp. 376-377, August 24-29, 2014, Rio De Janeiro, Brasil.

• J. Hallström, A. Bergman, S. Dedeoglu, A.P. Elg, E. Houtzager, T. Lehtonen, T. Klüss, W. Lucas, A. Merev, T. Nieminen, J. Meisner, E.P. Suomalainen, M. Schmidt, and C. Weber, "Performance of a modular wideband 1000 kV HVDC reference divider", 2014-CPEM (Conference on Precision Electromagnetic Measurements), pp. 782-783, August 24-29, 2014, Rio De Janeiro, Brasil.

• J. Hallström, A. Bergman, S. Dedeoglu, A.P. Elg, E. Houtzager, T. Klüss, T. Lehtonen, W. Lucas, A. Merev, J. Meisner, T. Nieminen, E.P. Suomalainen, S. Svensson and C. Weber, "New references for HVDC metering" Proceedings of 2014 Cigre Session, SC A3 High Voltage Equipment, A3_106_2014, 24-29 August 2014, Paris.

• A. Merev, A. Bergman, S. Dedeoglu, A.P.Elg, J. Hallström, E. Houtzager, W. Lucas, J. Meisner, M. Schmidt, E.P. Suomalainen and C. Weber, "Construction of a 200 kV HVDC Reference Divider", 2nd International Istanbul Smart Grid Congress and Fair, 8-9 May 2014, Istanbul, Türkiye.

2013 - 2014

IMPEDANCE LABORATORY

Research Activities:

• Development of a programmable 1 fA – 100 pA DC Current Source

EMRP / EMPIR

• SIB53 Aim Qute "Automated impedance metrology extending the quantum toolbox for electricity". In the scope of WP3.1, resistive dividers with ratios of 1/3, 1/5, 1/7 have been designed and constructed. The resistive dividers have been delivered. Temperature controlled phase standards with the values of \pm 30° and \pm 60° have been designed and constructed.

Other Projects:

• In the scope of SASO project: Design and construction of Maxwell-Wien Bridge. Design and construction of Wheatstone High Resistance Comparison Bridge.

- Automation of the calibration of the RLC meters
- Construction of 6 pieces of 4-decade and 4 pieces of 7-decade inductive voltage dividers for LNE.

Comparisons: None

Extending Capabilities: None

Publications:

• "Gülmez G, Gülmez Y, Turhan E, Özkan T, "Construction of Temperature Controlled Passive Phase Standards", URSI Turkey, 2014

• Gülmez Y, Turhan E, Gülmez G, Özkan T, "Inductance Measurement at nH Level", URSI Turkey, 2014

• Turhan E, Gülmez G, Gülmez Y, Özkan T, "Inductive Voltage Divider Calibration at Primary Level", URSI Turkey, 2014

• Özkan, T, Gülmez G, Gülmez Y, Turhan E, "Calibration of Standard Capacitors Using Resonance of s-parameters" URSI Turkey, 2014

• F. Genc, E. Turhan, H. Kavas, U. Topal, A. Baykal, H. Sozeri, "Magnetic and Microwave Absorption Properties of NixZn0.9-xMn0.1Fe2O4 Prepared by Boron Addition", J Supercond Nov Magn., September 2014.